

# PATENT ABSTRACTS OF JAPAN

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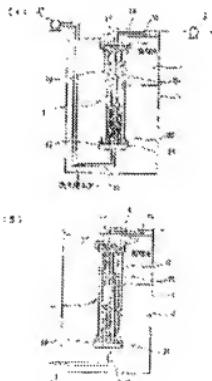
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## (54) FILTER DEVICE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To keep a good filtering capacity over a long period of time by peeling and removing a suspended component bonded to and deposited on a hollow fiber without exerting an effect on the filtering capacity of the hollow fiber.

**SOLUTION:** In the subject filter device constituted so as to pass a liquid to be treated containing the suspended component through the hollow fiber for immersion type suction filtering or external pressure filtering to perform solid-liquid separated, a cartridge, which has a large number of hollow fibers arranged thereto so as to leave required gaps and is equipped with a fixing member, wherein both terminals of the hollow fibers are fixed by a resin, is provided, the terminals of the hollow fibers fixed to the fixing member on one end side of the cartridge are sealed while through-holes are provided to the fixing member at the parts held between hollow fiber fixing parts, an air introducing cap connected to an air introducing pipe is attached to the surface opposite to the hollow fiber protruding side of the fixing member in a state of hermetical closure, pressurized air is jetted to the gaps between the hollow fibers from the air introducing cap through the through-holes while a water gathering header connected to a water gathering pipe is attached to the fixing member on the other end side of the cartridge in a liquidtight state and the terminal of the hollow fibers are opened to be allowed to face to the water gathering header.



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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[Field of the Invention]****[0001]**

This invention relates to the filter equipped with a clarification means to remove the suspension component which adheres to a hollow filament side especially, about the filter which is made to penetrate a hollow filament for the processed liquid containing a suspension component, and performs solid liquid separation.

**[Background of the Invention]****[0002]**

It converges on a circle configuration, the hollow filament of an a large number book is arranged, and it is used, equipping dipping former suction filtration equipment or an external pressure type filter with the membrane module which fixed the one end section or both ends in the holdown member in the state of opening, and was used as the water collecting part. Conventionally, the membrane module has been widely used in the so-called field of water purification processings, such as river water and lake water purification. Moreover, not only this water purification field but many examination to the high-polluted-water processing application of filtration of the secondary treatment of sewage, tertiary treatment, wastewater, industrial waste water, industrial water, etc., etc. is made recently.

**[0003]**

If filtration processing is continued with the filter using a membrane module, in any [ of water purification and high-polluted-water processing ] case, the suspension component contained in a processed liquid will deposit between a film front face or the film, and it will cause this film lock out. That is, hollow filaments carry out fixing unification through a deposit, the effective film surface product of the hollow filament in a membrane module decreases, and the fall of a transparency flow rate is caused.

**[0004]**

For this reason, washing actuation which removes the deposit of a film surface periodically is performed. In an immersion tub, washing introduces air from the lower part of a membrane module, where a processed liquid is filled, and the approach of exfoliating the deposit of a film surface in Ayr bubbling which gives vibration to a hollow filament with the air bubbles supplied is taken.

**[0005]**

For example, in the patent No. 3011248 official report (patent reference 1) in the approach of filtering a liquid while the air bubbles supplied from powder pore 102a of the diffusion plate 102 which the sheet-like flat tip hollow fiber module 101 formed caudad perform Ayr bubbling continuously or intermittently to a

hollow filament 103, as shown in drawing 10 a sheet surface perpendicularly. A membrane module 101 is arranged so that a hollow filament may become horizontal, and the filtration approach of vibrating a hollow filament 103 by Ayr bubbling is indicated.

[0006]

Moreover, in JP,8-215548,A (patent reference 2), as shown in drawing 11, while fixing by the holdown member and giving a catchment function, maintaining the one end section 106 or the both ends 106,107 of a hollow filament 105 at an opening condition, powder pore 106a is prepared in the one end section (lower limit section) 106, an aeration function is given, and the membrane module which carries out film surface washing of the hollow filament 105 by the Ayr bubbling cleaning method is indicated.

[0007]

Furthermore, in JP,7-61420,B (patent reference 3), a hollow filament is vibrated introducing air from the lower part of the porosity pipe 112, and raising air bubbles along with the porosity pipe 112 by arranging many hollow filament filtration membranes 110 in an outer case 111, and making the porosity pipe 112 mix into a hollow filament bundle, as shown in drawing 12, and the filter which performs Ayr bubbling is indicated.

[0008]

Furthermore, in the \*\* table No. 542013 [ 2002 to ] official report (patent reference 4), as shown in drawing 13 (A) and (B), the skirt-board section 120 for air reservoirs is formed in the lower limit of a cartridge 101, and it is considering as the structure which introduces the air for clarification between hollow filaments from this skirt-board section 120.

[0009]

However, since it is what performs aeration in said patent No. 3014248 official report ( drawing 10 ) by the filtration approach of a publication ranging from powder pore 102a to the module whole region of a diffusion plate 102, in order to fully perform aeration, it is difficult to make the flat tip hollow fiber module 101 of the shape of an adjoining sheet estrange to some extent, to arrange it, and to install the film by high density. Therefore, the volume of the film installation section becomes large. Moreover, only by on the whole performing aeration from the lower part of a membrane module 101, aeration only of the front face of a hollow filament 103 is carried out, and there is a problem which becomes inadequate [ the aeration to the water collecting part neighborhood to which especially membranous lock out tends to go ] between film.

[0010]

Similarly, in a membrane module given in said JP,8-215548,A ( drawing 11 ), in order to give aeration structure to the one end section (lower catchment tubing) 106 of a membrane module and to carry out aeration from powder pore 106a, aeration is carried out only to the external surface side of a hollow filament 105, aeration does not attain to an inside side, and it cannot be said from the field of washing effectiveness that it is enough. Moreover, there is a problem of being inapplicable in the membrane module which carried out the focusing array of many hollow filaments at the circle configuration.

[0011]

Furthermore, in a filter given in said JP,7-61420,B ( drawing 12 ), since two or more porosity pipes 112 are made to only mix into the hollow filament bundle which arranged many hollow filament filtration membranes 110 in the circle configuration, there is a problem which becomes inadequate [ the aeration of a between / film ].

Furthermore, since pneumatic pressure is wide opened with the structure shown in

said \*\* table No. 542013 [ 2002 to ] official report ( drawing 13 ) when air once piles up in skirt-board circles, there is little oscillating effectiveness of a hollow filament.

[0012]

Furthermore, the hollow filament which uses the former is fabricated by resin, such as PSF, PVDF, and PE, and when the thickness of a hollow filament has the large gas pressure force which is the point of reinforcement, especially tensile strength and is injected from a powder trachea by about 0.5-mm, the problem from which fracture arises is in a hollow filament. Therefore, there is a problem that the function which carries out exfoliation removal of the suspension component which was made to generate air bubbles from the terminal side of about about 1m long picture hollow filament, and has stopped to carry out the load of the fine vibration to a hollow filament, consequently adheres firmly on the surface of a hollow filament especially only in bubbling by air bubbles is weak.

[0013]

[Patent reference 1] The patent No. 3014248 official report

[Patent reference 2] JP,8-215548,A

[Patent reference 3] JP,7-61420,B

[Patent reference 4] \*\* table No. 542013 [ 2002 to ] official report

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0014]

This invention makes it the technical problem to offer the filter which gives vibration, carries out exfoliation removal efficiently certainly to a hollow filament, and can defecate the suspension component which it was made in view of the above-mentioned problem, and was deposited between a film front face or the film by continuation of membrane filtration.

[Means for Solving the Problem]

[0015]

In order to solve said technical problem, this invention is a filter which the hollow filament for the object for dipping former suction filtration or external pressure filtration is made to penetrate the processed liquid containing a suspension component, and performs solid liquid separation.

A necessary opening is opened and arranged to the hollow filament of an a large number book, and the cartridge equipped with the holdown member which fixed the both-ends end of these hollow filaments by resin is prepared,

While closing the terminal of said hollow filament fixed to said holdown member by the side of the end of said cartridge, preparing a through tube in the part pinched by this holdown member at said hollow filament fixing section, attaching in an opposite side the gas installation cap connected with gas installation tubing in the state of sealing the hollow filament protrusion side of said holdown member and making the opening between hollow filaments inject a pressurization gas through said each through tube from said gas installation cap,

the catchment header connected with catchment tubing at said holdown member by the side of the other end of said cartridge -- liquid -- attaching densely, the terminal of said hollow filament offers the filter characterized by carrying out opening and making said catchment header attend.

[0016]

As described above, in this invention, the through tube which makes the holdown member made of resin (the so-called potting section) itself which fixes many hollow filaments of a book inject the gases for clarification (air etc.) is prepared, so to speak, it uses as the nozzle section, and structure is

simplified. And since the through tube which carries out pressurization injection of the gas is drilled between the adjoining hollow filaments, the load of the vibration can be certainly carried out on the surface of a hollow filament, and the suspension component adhering to the film surface of a hollow filament can be removed.

Furthermore, it can be made to inject from said through tube, since the gas installation cap is attached in the airtight condition to said holdown member, without attenuating the pressure of the pressurization gas to introduce. [0017]

said cartridge has rigidity for between the holdown members of said upper and lower sides which fix the both-ends end of said hollow filament -- it has connected with the connection supporting material of the shape of cylindrical or a pipe.

Said connection supporting material forms from a pipe, and this pipe uses as the porous pipe which covers the overall length of the direction of an axis, opens spacing, and has a gas nozzle preferably, and the end of this porous pipe fixes to the holdown member by the side of said gas installation cap attachment in the state of opening, and it is carrying out as the configuration which makes a pressurization gas introduce and makes a pressurization gas blow off from opening which this gas installation cap was made to face towards said hollow filament from said gas nozzle.

[0018]

As said connection supporting material, the object which covered the tube made from plastics can be used for metallic materials, such as SUS, or a polyvinyl chloride, a rigid plastic ingredient, and said metallic material.

Thus, if the holdown member of both ends is connected with the connection supporting material which has rigidity and the dimension between holdown members is specified, even if the load of the vibration according the hollow filament of a large number attached in the meantime to injection of a pressurization gas is carried out, it can hold in the straight-line condition, without bending.

Although tensile strength is required of each hollow filament for that purpose, injection of pressurization air in the clearance between hollow filaments is directly enabled by forming the hollow filament which consists of a material which has high tensile strength, such as PTFE, so that it may mention later. Said connection supporting material may open and arrange spacing in the periphery location of the converging hollow filament, and it may arrange it so that a hollow filament may be made intermingled in the internal location which is converging.

And if connection supporting material is used as the porous pipe, a hollow filament will be continued throughout the direction of an axis, the load of the vibration can be carried out, and the exfoliation removal of the suspension component can be carried out certainly.

[0019]

between the hollow filaments which adjoin while the center distance (pitch) of said hollow filament carries out parallel arrangement of said cartridge as 2-20mm -- a 0.5-10mm opening -- opening -- arranging -- this whole cartridge configuration -- a cross section -- it is considering as the shape of circular or a rectangle.

Thus, respectively the both ends of the hollow filament to arrange opened spacing in the direction of X-Y, fixed to said vertical holdown member, and have prepared opening in said gas jet among these hollow filaments.

[0020]

or the hollow filament focusing object which converged in the shape of a layer in

the shape of a horizontal section rectangle was established, and the through tube for said gas injections is opened in the holddown member between the hollow filament focusing objects which end, arrange and these-adjoin said hollow filament focusing object which opens necessary space, carries out parallel arrangement of the hollow filament focusing object, and carries out this parallel arrangement of this in a 2-20mm opening.

In addition, the configuration of a cartridge is not limited to said configuration, but can be made into various gestalten.

[0021]

The magnitude of a through tube used as the gas nozzle for clarification drilled in said holdown member is set up according to the magnitude of the suspension component of the processing liquid which carries out solid liquid separation. That is, in order to inject a pressurization gas from a through tube, at the time of this gas injection, there is no possibility that a suspension component may flow into a through tube, but also when gaseous injection is stopped, it is desirable to consider as a dimension setup into which a suspension component cannot flow from a through tube.

the cartridge immersed in the activated sludge tank which for example, sewage-treatment water makes flow -- the diameter of a through tube -- the range of 2mm - 6mm -- about 3-4mm is more preferably good.

[0022]

as the gas introduced into said gas installation cap -- air -- using -- this air pressure -- the range of 50-500kPa -- it is preferably set as 100-300kPa.

Pressure air is supplied using Blois. In addition, although a compressor may be used, while air pressure becomes strong too much, Blois is more advantageous in cost.

[0023]

Moreover, according to this product, for example to amount of setting filtered water 100 L/hr of a cartridge, although few amounts of gas installation aiming at membranous washing are so good that there are from the power consumed to operation of Blois, i.e., the field of a running cost, although 1-10Nm<sup>3</sup>/hr and this better \*\* have the desirable range of 3 2-4Nm, the amount of suspension components which the amount of filtered water separates responds, and it is set up suitably.

[0024]

The hollow filament of said cartridge is overly formed by detailed porosity from ceramics, such as fluororesin, such as PTFE (polytetrafluoroethylene) and polyvinylidene fluoride, a porosity alumina, and porosity silicon nitride. Constituting from PTFE especially is desirable and it is stable to an acid, alkali, and a solvent by being referred to as PTFE, and since it can be made hard to adhere a suspension component since it excels in water repellence and excels in flexibility further, processing is easy.

Even if it blows off a pressurization gas from the pipe for clarification by setting tensile strength to 3 or more kgves, and giving strong tensile strength especially, a hollow filament is not made to generate bending and damage.

In addition, the material of a hollow filament is not limited above but can use what consists of various kinds of ingredients, such as polyolefines, such as polysulfone system resin, a polyacrylonitrile, a cellulosic, polyethylene, and polypropylene, polyvinyl alcohol system resin, polysulfone system resin, a polyamide, polyester, polymethacrylate, and polyacrylate. Moreover, you may be resin which could introduce the substituent into a copolymer or some of these resin, and mixed two more or more sorts of resin.

[0025]

A hollow filament is the bore of 0.5-12mm. It is desirable to have had the pressure resistance of differential pressure 0.1-1.0MPa between the outer diameter of 1.5-14mm, 50nm - 1000nm of diameters of super-micropore, 0.5-1mm of thickness, 50 - 80% of porosity, and the film.

If the above mentioned hollow filament is used, it is applicable to filtration of the processed liquid containing various suspension components.

[Effect of the Invention]

[0026]

As mentioned above, while attaching a gas installation cap in the holdown member (it is a lower holdown member when carrying out vertical arrangement of the cartridge) of one side of the cartridge which is fixing both ends for many hollow filaments by the holdown member (potting section) in the state of sealing according to the filter of this invention A through tube is prepared in the location between the hollow filaments of this holdown member, since it is considering as the configuration which a pressurization gas is made to inject directly into the opening between hollow filaments from this through tube, vibration can be certainly given to a hollow filament and exfoliation removal of the suspension component deposited between a film front face or the film can be carried out efficiently.

Furthermore, if the hollow filament itself has high tensile force, and this connection supporting material is used as a porous pipe and a pressurization gas is made to inject towards a hollow filament also from this porous pipe while connecting an up-and-down holdown member with connection supporting material and holding a hollow filament in the shape of a straight line, it can prevent that carry out the load of the vibration to a hollow filament more certainly, and a suspension component adheres and deposits on the front face of a hollow filament.

A through tube is prepared in the location corresponding to the opening between hollow filaments at a holdown member, and since only \*\*\*\* is required, size, an arrangement location, etc. of an opening between hollow filaments can be designed freely further again.

[Best Mode of Carrying Out the Invention]

[0027]

Hereafter, the operation gestalt of this invention is explained with reference to a drawing.

Drawing 1 thru/or drawing 4 show the 1st operation gestalt which applied this invention to dipping former suction filtration equipment.

The 1st operation gestalt is immersed in the filter of this invention in the lauter tub 3 which consists of an activated sludge tank containing sewage treatment water 2, and carries out filtration processing of the sewage with a membrane-separation activated sludge process.

[0028]

Said filter was equipped with the cartridge 1, and this cartridge 1 opened the necessary opening, has arranged many hollow filaments 10 of a book, carried out the mold of the both-ends end of these hollow filaments 10 by resin, and equips the predetermined location with the fabricated holdown members 11 and 12 which carried out positioning immobilization.

As shown in drawing 2 and drawing 3, the pitch of said hollow filament 10 set to 2-20mm, has opened spacing of 0.5-10mm between the adjoining hollow filaments 10, and has opened spacing of 5mm with this operation gestalt.

The holdown members 11 and 12 of said upper and lower sides stiffen liquefied resin, such as an epoxy resin, an unsaturated polyester resin, and polyurethane resin, and are fabricating it.

The whole cartridge 1 configuration is made into a horizontal section round shape, and also makes the disk configuration the up-and-down holddown members 11 and 12.

[0029]

said hollow filament 10 consists of PTFE (polytetrafluoroethylene) -- it overly forms from detailed porosity material. As this hollow filament, a bore can respond what 50nm - 1000nm and porosity prepare for 50 to 80 , and tensile strength prepares [ 1.5-1mm and thickness / 0.5-mm and die length / about 1000mm and the diameter of super-micropore ] with the pressure resistance of differential pressure 0.1-1.0MPa between 3 or more kgves and the film to 0.5-12mm, an outer diameter can respond to an application, and it can use.

With this operation gestalt, a hollow filament 10 is 1000mm in the bore of 1mm, the outer diameter of 2mm, and die length, converges these hollow filaments 10 400-500, and is setting the diameter of a cartridge 1 to 150mm.

[0030]

it is shown in drawing 4 -- as -- the upper part of the up holddown member 11 -- the catchment header 13 -- liquid -- fix densely, the catchment header 13 is made to face the upper limit of a hollow filament 10 with an opening condition, and the processed liquid with which the interior of a hollow filament 10 was filtered is brought together in the catchment header 13. The catchment tubing 14 is connected with this catchment header 13 free [ attachment and detachment ], and processed liquid is attracted with the suction pump 15.

Said catchment header 13 is fabricated with the quality of the material which has a mechanical strength and endurance, for example, a polycarbonate, polysulfone, polyolefine, a polyvinyl chloride, acrylic resin, ABS plastics, denaturation PPE resin, etc. are used for it.

[0031]

On the other hand, as shown in drawing 3 , the lower limit of the hollow filament 10 fixed by the lower holddown member 12 is closed, and is used as the closing edge. The through tube 20 is formed in the location between the hollow filaments 10 fixed to this lower holddown member 12.

The diameter of each through tube 20 is set to 2-6mm, and is set to 4mm with this operation gestalt. The through tube 20 which forms a hollow filament 10 in the holddown member 12 of the location between these hollow filaments 10 since it protrudes upward also opens spacing in the direction of X-Y in the direction of X-Y, and said holddown member 12 is puncturing it.

[0032]

The gas installation cap 21 for clarification is fixed to the whole inferior surface of tongue of said lower holddown member 12 in airtight one through packing 26 between holddown members 12. This gas installation cap 21 is made into the shape of a cylindrical shape which has a flat base by the shallow bottom, and is made into the configuration which has the passage of a narrow width between the lower holddown members 12. Thus, the gas installation cap 21 is made into a sealing condition, and the interior and said through tube 20 are opened for free passage, and it is considering as the configuration which can be injected without decompressing the pressurization air introduced into the gas installation cap 21 from a through tube 20.

The air installation tubing 22 is connected in the center of a base of said gas installation cap 21, and pressurization air which flows in the gas installation cap 21 is considered as the configuration which carries out pressurization injection in the opening between hollow filaments 10 more directly than a through tube 20.

[0033]

Said air installation tubing 22 was connected with Blous 27, and has introduced the pressurization air of the range of pneumatic pressure 50-500kPa into the gas installation cap 21.

[0034]

Moreover, in said cartridge 1, spacing was opened in the hoop direction for the periphery part of an up-and-down holdown member, and it has connected with the connection supporting material which consists of a porous pipe 25 which has rigidity. In this operation gestalt, the up-and-down holdown members 11 and 12 are connected in the porous pipe 25 of 6 \*\*.

Said porous pipe 25 is formed by the product made from a polyvinyl chloride, covers the whole direction of an axis, and the perimeter, opens spacing, and is drilling hole 25a for gas injections in the peripheral wall.

Said porous pipe 25 is carrying out mold immobilization with the hollow filament 10 by using upper limit as a closing edge at the holdown member 11. On the other hand, as an opening edge, mold is carried out to a holdown member 12, it fixes to it with a hollow filament 10, and the lower limit is making said gas installation cap 21 overlook a lower limit opening edge in the state of opening.

[0035]

Although drawing 1 simplifies and shows the condition that one cartridge 1 is immersed in a lauter tub 3, said cartridge 10 opened necessary spacing in front and rear, right and left, and is immersed in a lauter tub 3. By connecting the catchment header 13 with the catchment tubing 14, these cartridges 10 are assembled in one and are.

[0036]

Below, an operation of the filter 10 of this operation gestalt is explained. The hollow filament 10 of each cartridge 1 is made to penetrate by the drive of a suction pump 15, solid liquid separation is performed, and the processed liquids 2 which were introduced in the immersion tub 3 and filled are collected as processed liquid from the catchment tubing 14.

[0037]

When carrying out exfoliation removal of the suspension component deposited between the front face of a hollow filament 10, or the film by continuation of membrane filtration, pressurization air is directly injected to the opening between the hollow filaments 10 which adjoin from the through tube 20 which the blower 27 was operated and was directly prepared in the lower holdown member 12 from the air installation tubing 22 and the gas air cap 21. The injected air bubbles go up touching the front face of the adjoining hollow filament 10, give vibration to a hollow filament 10, and carry out exfoliation removal of the suspension component from the front face of a hollow filament 10.

Although it is desirable to always perform jet of said pressurization air, you may carry out intermittently.

[0038]

Since air is injected also from hole 25a drilled in coincidence by the peripheral wall of the support pipe 25, vibration can be given [ ] of a cartridge 1 [ ] covering the overall length of the direction of an axis of a hollow filament 10 from a periphery.

[0039]

Thus, the holdown member of the lower part which fixes a hollow filament is used as an injection pipe of the air for clarification, and the through tube for air jet is prepared in the location between the adjoining hollow filaments, and it can be injected by the opening between hollow filaments, without air declining, since it is considering as the configuration which pressurization air can introduce into this through tube directly. Therefore, the load of the vibration

stronger than before can be carried out to a hollow filament. Furthermore, since pressurization air is introduced also into the support pipe which holds a vertical holddown member in predetermined distance and pressurization air is made to inject also from the hole of the peripheral wall, vibration is given over the whole region of the direction of an axis of a hollow filament, the exfoliation removal of the suspension component adhering to a hollow filament can be carried out, and a filtration efficiency can be held highly.

In addition, even if it is the case where the hole is not opened in said support pipe, exfoliation removal of the suspension component which gives vibration to a hollow filament and adheres to a hollow filament only with the pressurization air injected from the through tube of a holdown member can be carried out.

[0040]

Drawing 5 and drawing 6 show cartridge 1' of the 2nd operation gestalt.

In cartridge 1' of the 2nd operation gestalt, the connection supporting material which consists of a porous pipe 40 of a hollow filament 10 and the diameter of the abbreviation same is used as a connection supporting material of the up-and-down holdown members 11 and 12. These porosity pipe is created by the polyvinyl chloride which has rigidity. Into drawing 6, said porous pipe 40 made four 1 set, as a black dot showed, and it opens and arranges spacing to the hoop direction so that the center position of cartridge 1' and the surroundings of it may be surrounded.

[0041]

Furthermore, it has surrounded within the cylinder pipe 45 which opened comparatively big running term 45a into which a processed liquid is made for the periphery of the focusing section of a hollow filament 10 to flow. This cylinder pipe 45 is the product made from a polyvinyl chloride which has rigidity, and has connected the vertical both ends with holdown members 11 and 12 up and down.

[0042]

As mentioned above, in order to attach the porous pipe 40, the pressurization air which spouts the number of filament in strand of a hollow filament 10 from the porous pipe 40 which do not need to decrease in number so much and is arranged in a hollow filament group can be made to act on the surrounding hollow filament 10, if the porous pipe 40 arranged inside the hollow filament group of cartridge 1' is made a hollow filament 10 and of approximately the same diameter.

[0043]

Drawing 7 and drawing 8 show cartridge 1" of the 3rd operation gestalt. The focusing gestalt of the hollow filament 10 of cartridge 1" is changed, six layers of film focusing objects 30 which converged in the shape of a layer are established so that a horizontal section may become rectangle-like about a hollow filament 10, and it constitutes from a 3rd operation gestalt in a horizontal section circle as a whole.

[0044]

It opens and said film focusing object 30 is fixed to the up-and-down holdown members 11 and 12 for necessary spacing. The through tube 20 prepared in a holdown member 12 is formed in the location between said adjoining film focusing objects 30.

With the 2nd operation gestalt, connection supporting material is not attached among the up-and-down holdown members 11 and 12.

Since other configurations are the same as that of the 1st operation gestalt, explanation is omitted.

[0045]

Exfoliation removal of the suspension component deposited between the film front face of the hollow filament 10 which can carry out the load of the vibration with the pressurization air of the peripheral face of each film focusing object 30 mostly injected from a through tube 20 in the whole region, is made to rock each film focusing object 30 efficiently, and constitutes this film focusing object 30 also from a 3rd operation gestalt, or the film can be carried out.

[0046]

"An example and the example of a comparison"

In the activated sludge tank containing the sewage treatment water of MLSS10000 mg/L, the filter of the example of this invention and the example of a comparison was immersed, and processing by the membrane-separation activated sludge process was performed on condition that the following.

The amount of setting filtered water 100 l/hr

The amount of air object installation 3Nm<sup>3</sup>/hr (the gas injection was always performed continuously)

Pneumatic pressure 200kPa

The suction pressure of processed liquid was measured according to filtration operation lapsed days, and the adhesion condition of the suspension component to a hollow filament was measured. There is the clarification effectiveness, so that suction pressure is small.

[0047]

As the bore of 1mm, the outer diameter of 2mm, 75% of porosity, 0.45 micrometers of apertures, and 1000mm of effective length show examples 1 and 2 and the example 1 of a comparison to said drawing 1 using 482 3m extension PTFE hollow filaments of 2 of film surface products it has arranged in a horizontal section circle as a whole, having used the pitch between hollow filaments as 5mm, the upper limit section and the lower limit section were fixed by the resin for immobilization (epoxy resin), the vertical holdown members 11 and 12 were created, and the cartridge 1 was produced.

[0048]

"Example 1"

The example 1 was equivalent to said 1st operation gestalt, and connected the up-and-down holdown member with connection supporting material from the porous pipe. Eight through tubes with a bore of 4mm were opened between the hollow filaments which adjoin a lower holdown member, and the gas installation cap was attached in the inferior surface of tongue of this holdown member at airtight one apparatus.

Spacing was opened in the periphery location in the hoop direction, eight porous pipes have been arranged, and it attached between up-and-down holdown members. The aperture of said porous pipe was set to 4mm, and one piece has been arranged to each serial towards the inside the film focusing side at intervals of 100mm pitch in the direction of an axis.

[0049]

"Example 2"

Although the through tube prepared in a lower holdown member made the example 2 be the same as that of an example 1 and it was connected by the up-and-down holdown member, this holdown member used what has not prepared the hole. Other configurations were made the same as an example 1.

[0050]

"The example 1 of a comparison"

Although the through tube was prepared in the lower holdown member like the example 1, the same skirt-board section as the patent reference 4 was prepared in the lower holdown member, and air installation tubing was connected just under

each skirt-board section.

[0051]

"The example 2 of a comparison"

Although the 5mm clearance was prepared between hollow filaments in examples 1 and 2 and the example 1 of a comparison, film surface area of the hollow filament focusing object which a clearance is clustered without preparing, converges, was these stuck between hollow filaments, and converged was set to 2 6m in the example 2 of a comparison. The through tube was prepared in the location which hits a holdown member in the periphery location of said hollow filament focusing object, and the pressurization air introduced into the gas installation cap as the same configuration as an example 1 was made to inject from a through tube.

[0052]

A measurement result is shown in following Table 1 and following drawing 9 .

[0053]

Suction pressure (\*\*P(kPa) )

Filtration lapsed days Example 1 Example 2 Example 1 of a comparison Example 2 of a comparison

Five days 5 7 7 8

10 5 7 7.5 11

15 5 7 8 18

20 5 7 9 25

25 5 7 12 40

30 5 7 15

35 5 7 18

40 5 7 21

45 5 7 25

50 5 7 30

55 5 7 32

60 5 7 38

[0054]

Since after 60-day progress is the same as for suction pressure, in the example 1 of this invention, and the example 2, it is admitted that the adhesion deposition of the suspension component is not carried out on the surface of a hollow filament, so that clearly also from the graph of said table 1 and drawing 9 . On the other hand, in the example 1 of a comparison, suction pressure increased gradually after progress on the 20th, 7 times of an example 1 and about 5 times [ of an example 2 ] suction pressure was needed after progress on the 60th, and it has checked that the clarification capacity on the front face of a hollow filament was inferior to examples 1 and 2.

Moreover, it is a check that it is necessary in the example 2 of a comparison to already need the suction pressure of 8kPa(s) when it passes [ of measurement initiation ] on the 5th, it is necessary to set suction pressure to 40kPa(s) when it passes on the 40th, and it is necessary to exchange cartridges, and it is \*\*.

[Availability on industry]

[0055]

Since the filter of this invention can carry out exfoliation removal of the suspension component which the hollow filament was vibrated certainly and deposited between the front face of a hollow filament, or the hollow filament efficiently, not only the water purification field but its membrane-separation activated sludge process uses and is the optimal in the target sewage field. Moreover, it is applicable also to the processing fields, such as industrial wastewater and zootechnics wastewater.

## [Brief Description of the Drawings]

[0056]

[Drawing\_1] The filter of the 1st operation gestalt of this invention is shown, (A) is a front view and (B) is a side elevation.

[Drawing\_2] It is the expansion top view of the lower holdown member of the 1st operation gestalt.

[Drawing\_3] It is an important section sectional view by the side of the lower holdown member of the 1st operation gestalt.

[Drawing\_4] It is an important section sectional view by the side of the up holdown member of the 1st operation gestalt.

[Drawing\_5] It is the front view of the cartridge of the 2nd operation gestalt.

[Drawing\_6] It is the A-A line sectional view of drawing\_5.

[Drawing\_7] It is the front view of the cartridge of the 3rd operation gestalt.

[Drawing\_8] It is the B-B line sectional view of drawing\_7.

[Drawing\_9] It is the graph which shows the test result of an example and the example of a comparison.

[Drawing\_10] It is the drawing in which the conventional example is shown.

[Drawing\_11] It is the drawing in which other conventional examples are shown.

[Drawing\_12] It is the drawing in which other another conventional examples are shown.

[Drawing\_13] The drawing which (A) shows still more nearly another conventional example, and (B) are the important section enlarged drawing sides of (A).

## [Description of Notations]

[0057]

- 1 Cartridge
- 2 Processed Liquid
- 3 Immersion Tub
- 10 Hollow Filament
- 11 Up Member
- 12 Lower Member
- 13 Catchment Header
- 20 Through Tube
- 21 Gas Installation Cap
- 22 Gas Installation Tubing
- 24 Porous Pipe

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[Translation done.]

\* NOTICES \*

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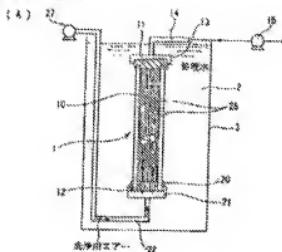
1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

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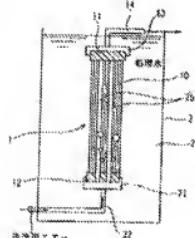
DRAWINGS

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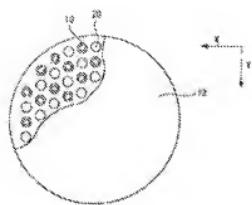
[Drawing.1]



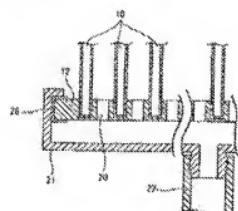
(B)



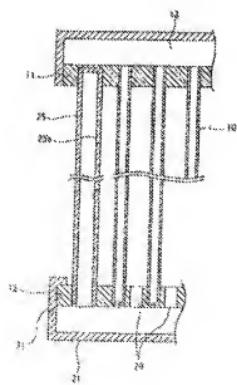
[Drawing.2]



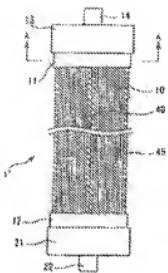
[Drawing 3]



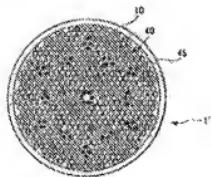
[Drawing 4]



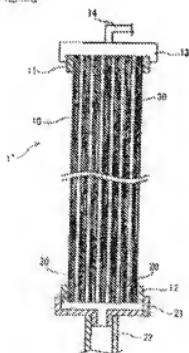
[Drawing 5]



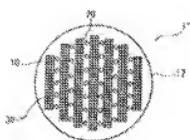
[Drawing 6]



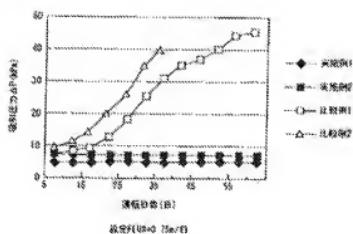
[Drawing 7]



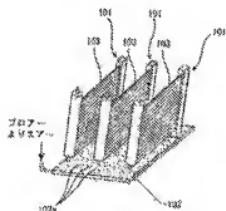
[Drawing 8]



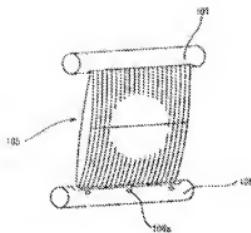
[Drawing 9]



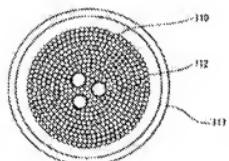
[Drawing 10]



[Drawing 11]

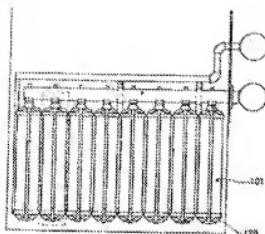


[Drawing.12]

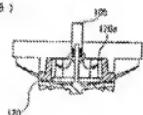


[Drawing.13]

(A)



(B)



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[Translation done.]